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an array of a plurality of printing elements and the printing medium, comprising the steps of:

relatively moving at least one of the printing head and the printing medium in a scanning direction crossing the array of the printing elements so that an array of printed pixels corresponding to the array of the printing elements is printed on the printing medium;

detecting printing positions of the array of printed pixels by detecting printed pixels printed by any of the plurality of printing elements; and

controlling drive timing of the plurality of printing elements according to detection results of the printing positions so as to make printing positions of subsequently printed pixels close to a predetermined center position, wherein said controlling step controls drive timing of any of the printing elements determined from the plurality of printing elements on the basis of displacements of printing positions of printed pixels so that a deviation amount between printing positions of printed pixels corresponding to one end side and the other end side of the array of printing elements is equal to or smaller than a predetermined amount.

REMARKS

Reconsideration and withdrawal of the rejections set forth in the above-mentioned Official Action in view of the foregoing amendments and the following remarks are respectfully requested.

Claims 1-5 and 7-11 remain pending in the application. Claims 1 and 11 are independent and have been amended herein.

Claims 1, 3, 4 and 7-11 were rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 5,448,269 (Beauchamp et al.). Claim 11 was rejected under § 102 as being anticipated by U.S. Patent No. 6,367,903 (Gast et al.). Claims 1-5 and 7-10 were rejected under 35 U.S.C. § 103 as being unpatentable over Gast et al. in view of U.S. Patent No. 6,227,644 (Pernier). These rejections are respectfully traversed.

As is recited in independent Claim 1, the present invention relates to a printing apparatus for printing an image on a printing medium while relatively moving at least one of a printing head provided with an array of a plurality of printing elements and the printing medium. The apparatus includes a carriage, detection means and control means. The carriage mounts the printing head, and is movable relative to the printing medium in a scanning direction crossing the array of the plurality of printing elements. The detection means is mounted on the carriage and detects printing positions of an array of printed pixels corresponding to the array of the plurality of printing elements. The detecting means also detects printed pixels printed by any of the plurality of printing elements. The control means controls drive timing of the plurality of printing elements according to detection results of the detection means so as to make printing positions of subsequently printed pixels close to a predetermined center position. The control means controls the drive timing of any of the printing elements determined from the plurality of printing elements on the basis of displacements of printing positions of printed pixels so that a deviation amount between printing positions of printed pixels corresponding to one

end side and the other end side of the array of printing elements is equal to or smaller than a predetermined amount.

As is recited in independent Claim 11, the present invention relates to a printing method for printing an image on a printing medium while relatively moving at least one of a printing head provided with an array of a plurality of printing elements and the printing medium. The method includes the steps of relatively moving at least one of the printing head and the printing medium in a scanning direction crossing the array of the printing elements so that an array of printed pixels corresponding to the array of the printing elements is printed on the printing medium, detecting printing positions of the array of printed pixels by detecting printed pixels printed by any of the plurality of printing elements and controlling drive timing of the plurality of printing elements according to detection results of the printing positions so as to make printing positions of subsequently printed pixels close to a predetermined center position. The controlling step controls drive timing of any of the printing elements determined from the plurality of printing elements on the basis of displacements of printing positions of printed pixels so that a deviation amount between printing positions of printed pixels corresponding to one end side and the other end side of the array of printing elements is equal to or smaller than a predetermined amount.

Support for the amendments to the independent claims can be found in the specification at least at page 11, line 7 through page 12, line 21, with respect to the discussion of Figs. 3A-3C. In this described embodiment, the predetermined amount is one dot, and the drive timing of printing elements (ink ejection openings) 40i-40l are shifted by

one dot printing time. That is, prior to controlling the driving time, these particular printing elements 40i-40l were outside the tolerable deviation range.

As discussed previously, Beauchamp et al. relates to an ink jet printer including a printhead and an optical sensor for sensing a test pattern. Beauchamp et al. describes how images created by nozzles deviate from an ideal position due to printhead speed and platen curvature. That is, Beauchamp et al. controls drive timings of all of the plurality of printing elements based on the scanning speed and the bending of a platen. Beauchamp et al. does not disclose or suggest controlling the drive timing of any printing elements determined from a plurality of printing elements on the basis of displacements of printing positions of printed pixels so that a deviation amount between printing positions of printed pixels corresponding to one end side and the other end side of an array of printing elements is equal to or smaller than a predetermined amount, as is recited in independent Claims 1 and 11.

Thus, Beauchamp et al. fails to disclose or suggest important features of the present invention recited in the independent claims.

Gast et al. relates to a technique for compensating for misalignment of dots of an ink jet printer. A pattern is printed on a medium and the printed pattern is detected by an optical sensor. Based on the detection, positional offset error is determined and timing correction is generated. While Gast et al. may determine a separate time correction for each printing element, it cannot be said that Gast et al. controls driving timing of any of the printing elements based on displacements of printing positions of printed pixels so that a deviation amount between printing positions of printed pixels corresponding to one end

side and the other end side of an array of printing elements is equal to or smaller than a predetermined amount, as is recited in independent Claims 1 and 11.

Thus, Gast et al. also fails to disclose or suggest important features of the present invention recited in the independent claims.

Pernier relates to a printer that utilizes an image array 15 having two imaging detectors 16 for each nozzle. However, Pernier fails to remedy the deficiencies of Gast et al. noted above with respect to independent Claims 1 and 11.

Thus, independent Claims 1 and 11 are patentable over the citations of record. Reconsideration and withdrawal of the §§ 102 and 103 rejections are respectfully requested.

For the foregoing reasons, Applicants respectfully submit that the present invention is patentably defined by independent Claims 1 and 11. Dependent Claims 2-5 and 7-10 are also allowable, in their own right, for defining features of the present invention in addition to those recited in their respective independent claims. Individual consideration of the dependent claims is requested.

Applicants submit that the present application is in condition for allowance. Favorable reconsideration, withdrawal of the rejections set forth in the above-noted Office Action, and an early Notice of Allowance are requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,


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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO CLAIMS

1. (Three Times Amended) A printing apparatus for printing an image on a printing medium while relatively moving at least one of a printing head provided with an array of a plurality of printing elements and the printing medium, said apparatus comprising:

a carriage mounting said printing head, and movable relative to the printing medium in a scanning direction crossing said array of said plurality of printing elements;

detection means mounted on said carriage for detecting printing positions of an array of printed pixels corresponding to said array of said plurality of printing elements, said detecting means detecting printed pixels printed by any of said plurality of printing elements; and

control means for controlling drive timing of said plurality of printing elements according to detection results of said detection means so as to make printing positions of subsequently printed pixels close to a predetermined center position, said control means controlling the drive timing of any of the printing elements determined from said plurality of printing elements [according to a difference in detection time, detected by said detection means, of printed pixels printed by at least two of said plurality of printing elements] on the basis of displacements of printing positions of printed pixels so that a deviation amount between printing positions of printed pixels corresponding to one end side and the other end side of said array of printing elements is equal to or smaller than a predetermined amount.

11. (Three Times Amended) A printing method for printing an image on a printing medium while relatively moving at least one of a printing head provided with an array of a plurality of printing elements and the printing medium, comprising the steps of:

relatively moving at least one of the printing head and the printing medium in a scanning direction crossing the array of the printing elements so that an array of printed pixels corresponding to the array of the printing elements is printed on the printing medium;

detecting printing positions of the array of printed pixels by detecting printed pixels printed by any of the plurality of printing elements; and

controlling drive timing of the plurality of printing elements according to detection results of the printing positions so as to make printing positions of subsequently printed pixels close to a predetermined center position, wherein said controlling step controls drive timing of any of the printing elements determined from the plurality of printing elements [according to a difference in detection time, detected in said detecting step, of printed pixels printed by at least two of the plurality of printing elements] on the basis of displacements of printing positions of printed pixels so that a deviation amount between printing positions of printed pixels corresponding to one end side and the other end side of the array of printing elements is equal to or smaller than a predetermined amount.

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